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U.S. ARMY MATERIEL COMMAND

SAFETY DIGEST

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The Safety Digest is an AMC Pamphlet prepared by the Safety Office, Headquarters, US Army Materiel Command. Its purpose is to disseminate information which can materially influence and improve safety programs at all command establishments.

Articles are included to supplement technical knowledge as well as practical knowledge gained through experience. They provide a basis for the further refinement of safety measures already incorporated in operating procedures and process layout. To achieve maximum effectiveness, the Safety Digest should be given widespread circulation at each AMC establishment.

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(AMCSF)

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AMC SAFETY DIGEST

AMCP 385-111
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IN THIS ISSUE

IF THE SHOE FITS

Earl E. Sheets, Safety Specialist
Sacramento Army Depot

We know you and we know your footprints. We know the names your victims call you after you have your accident and we know some of the more gentle names that you and your friends use. Some of your friends call you "accident prone," but we know that all things being equal, no one is more "accident prone" than another. He may be more reckless, less alert, more inclined to show off or maybe less intelligent, or even just more stupid. That's some of the names for the "accident-going-somewhere-to-happen-shoe."

Even though we seldom see the person while he is wearing the so-called "accident shoe," we can see the footprints of that shoe all over the depot. Yellow paint from tugs and forklifts are left behind as reminders of minor scrapes.

Skid marks where panic stops were made or where vehicles were being abused leave telltale traces. Minor cuts and abrasions often indicate that someone was lucky and the result of their accident was minor, the only difference between amputation and a small cut being a matter of inches.

Accidents don't just happen. They are caused by people who do something wrong or fail to do something right. Accidents happen when a dangerous situation and someone who is wearing the "accident shoe" meet at the same time and place. They are sometimes caused by a usually sensible person who is guilty of a split second of inattention that can never be recalled.

We know your names and we know you must be stopped because sooner or later whoever is wearing "the shoe" and leaving footprints of yellow paint, near misses, vehicle abuses, small cuts and minor abrasions will be involved in a major accident. If not stopped for his own sake, then please, for our sake, because he might take us with him when he has his accident. DON'T LET THE SHOE FIT YOU!

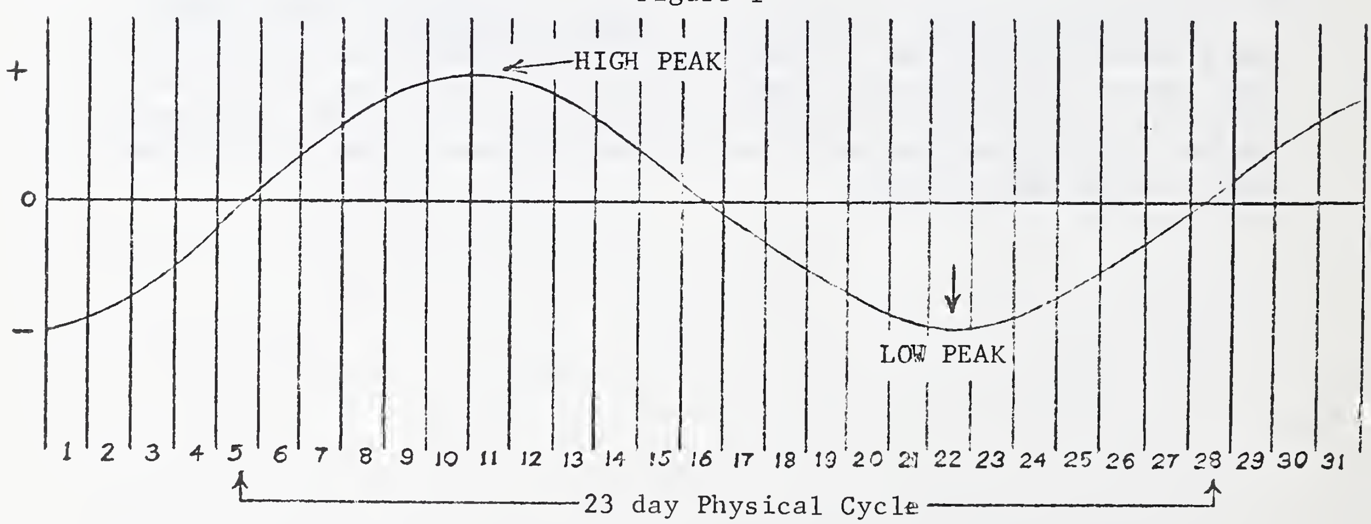
BIORHYTHMS

Most people are vaguely aware that their moods, emotions, energies, and even their physical strengths are constantly undergoing change from day to day. These fluctuations within our biotic selves are accepted with little afterthought. We do not consider it occult or mystic that these organic processes are occurring within us; neither do we have a sound, proven explanation for this phenomenon.

Scientists use the term biological clock to describe this variety of cyclic or rhythmical changes within plants, animals and humans. All life, down to the single cell, is recognized as rhythmical and highly organized. The word <u>biorhythm</u> is widely used to illustrate these pulsations within our body. The etymology of this latter term shows it to be a Greek compound of "bios," meaning life, and "rhythmos," meaning a regulated beat.

Early research allegedly identified certain of these basic rhythms in man as being a 23-day physical cycle, a 28-day sensitivity cycle and a 33-day intellectual cycle. These three cycles are often charted to show the ups and downs of biological rhythm. High and low peaks of performance are indicated on those charts by position of the curve above or below the axis. The biorhythm change from a high peak to a low peak is noted when the curve crosses the axis. Critical days, those days showing an affinity to human error, are identified as appearing to develop when a rhythm starts a new cycle, or in other words, when the curve crosses the axis. Supposedly, a person should be more careful during critical days because his system is purported to be in a state of flux and to have a considerable degree of instability.

Figure 1



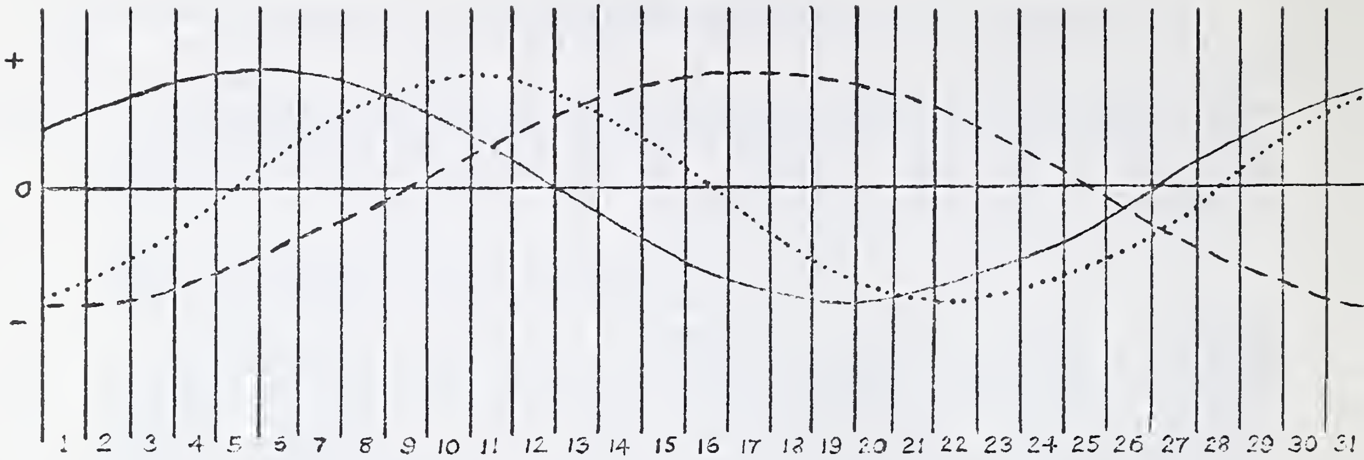
Critical days in themselves are not designated as dangerous. They are days during which the individual's reaction to his environment may bring about a critical situation. The highs and lows are not thought to have as profound an influence on the human-error element as the critical days. This is held to be especially true if two of the rhythms are in opposition to each other -- that is, one high and the other low -- since an element of adjustment or compensation supposedly takes place.

The 23-day rhythm is believed to originate in the muscular cells or fibers. Its fluctuations are considered to affect man's physical strength, endurance, energy, resistance and physical confidence. Days within the first half of the cycle are considered to be those when a person feels vigorous, his vitality and endurance are at their best, and when physical work seems easier. During the second half of the 23-day rhythm, a person is thought to be inclined to tire more easily. A complete 23-day cycle is charted with 11½ days above the axis and 11½ days below the axis. The two important points in this rhythm are the first day a new cycle begins, and the halfway mark when the cycle crosses the chart's axis on its downward phase. These days are the critical or flux days.

The 28-day rhythm, or the sensitivity cycle, supposedly governs the nervous system. This sensitivity rhythm also is divided into half-periods. The first 14 days represent the period during which a person is considered more inclined to optimism and cheerfulness. It is thought this period favorably influences creative enterprise, feelings, love, cooperation, and all coordination that is connected with the nervous system. The second half, from the 15th to the 28th day, represents the period during which a person is more inclined to become irritable and negative. Excitable people presumably will find their sensitivity extremes more noticeable than calmer people. The 28-day sensitivity rhythm registers its critical days during the first day of a new cycle and again during the 15th day when the phase can be charted switching downward across the axis.

The 33-day intellectual rhythm is surmised to originate in the brain cells. During the first 16½ days of this rhythm, people are imagined to be able to think more clearly, the memory functions well and mental response is most spontaneous. This period is considered the best time to absorb new subjects. The second 16½ days of the 33-day cycle represents the period when the capacity to think is reduced, or, in other words, when it is more difficult to absorb new subjects and it would be more expedient to rehearse or practice previously studied subjects. The critical days in the 33-day intellectual cycle are, again, the days a person supposedly must observe more closely. They are the first and the seventeenth day, representing respectively the start and the halfway mark of the 33-day rhythm.

Figure 2



Physical........... Sensitivity___________ Intellectual_ _ _ _ _ _ _ _

Supposedly, the study of these life rhythms can help forecast the subtle influences that may affect man's disposition and capabilities. Such advance indications are not thought to predict accidents although the way a person acts depends on what is happening to him and around him as well as the condition he happens to be in physically, emotionally, and intellectually at a particular time. Biorhythm is not the magic answer to accident prevention some safety personnel dream of. It is, however, reportedly under study at Sandia Laboratories in the United States, Ohmi Railway Company in Japan, and also in Switzerland as a method for suggesting when the potential human disposition on a certain day is such that outside influences or circumstances present a more dangerous threat than at other times. It is believed that unless external events place the individual in a potentially dangerous situation, critical days will ordinarily pass unnoticed.

A biorhythm chart should be interpreted in the light of each individual's age, health, character and temperament. The biorhythm chart is a relative picture that has to be studied from all angles.

For further reference on this controversial subject, readers are directed to:

1. "Is This Your Day?", by George Thommen, Crown Publishers, Inc., New York, $4.95.

2. Biorhythm Computers, Inc., 298 Fifth Avenue, New York.

3. Time Magazine, January 1972.

4. Family Safety Magazine, Summer 1972, National Safety Council.

WHAT ARE YOU DOING ABOUT IT?

A popular subject for discussion in aviation safety these days, and for some years past has been the subject of Complacency. Thousands of words of caution have been written. Month after month we read warnings in the safety journals: "Don't be Complacent!" We are exhorted "Complacency kills"; "Complacent attitudes breed accidents"; "Your complacency about unsafe situations may mean your job."

Although nearly everyone by this time has had a hack at Complacency, few have really done anything about it. One of the prime reasons for the lack of achievement is because the word, though widely used, has not been properly defined.

"The accident was caused by the pilot's complacent attitude about the weather with the result that he went beyond his or the aircraft's capacity." "I've been this route before and we can make it on the fuel remaining" said Tom complacently. "I know all about thunderstorms - follow me." These are sentences, sometimes Life Sentences, alluding to the concept of complacency.

Definitions from Webster's and other dictionaries fall short of our needs and in many cases obviously do not connote the word as we use it. Popular usage would seem to indicate that we use the word when we want to show that a person - a pilot - appears to be well satisfied with the situation and in spite of evidences or information to the contrary is unable to assess the situation except from a highly optimistic point of view. Although other persons might see danger in a particular course of behavior the complacent pilot is able to see only the successful outcome of the action. Although other persons find it increasingly difficult to remain content in a given working situation the complacent one finds no difficulty in doing business as usual.

One of the unique facets of complacency is our strange resistance to change. We dislike relinquishing our attitudes, unrealistic though they are. The truly complacent person even becomes overtly hostile to others who would change his attitude, though they have his safety in mind.

It is this resistance to change that leaves us non-plussed when we try to deal with the complacent person. We expect the person to react rationally to our warnings, because he appears rational in all other ways. It surprises us when he reacts irrationally and resists rational methods of acting.

Well, what is complacency and how does it get started? Complacency is a fantasy form of living which we all use as a way of protecting ourselves from the frightening thought that we might not be here tomorrow morning.

When we are very young we have no concept of time, space, purpose, or cause and effect. For the first few years of life we drift along in a world that has no change, in a world that we see as relatively the same day after day. We expect that the same person will deliver us a warm bottle any time that we want it. We expect no gross changes in the world about us. And that is just the way we want to keep it.

In this world of the infant there is no growing up. There is no yesterday and certainly no tomorrow. What is here will always be here. What he wants he will always get. (Luckily his wants are fairly limited.) But soon he learns that he is being propelled through time and that each day will never be the same as the last - like it or not he is growing up and things are changing. He learns that his control over the world is very limited - even that warm bottle may not be there one day when he calls for it.

This discovery of his relative impotence in a changing world is the first of a series of disconcerting revelations. He also learns in short order that the person who brings the warm bottle may not always be there - may never come again. He also learns that he might not be there himself someday - that there is a vague state called death! It is with the learning of these tidbits of information that the child begins to cling closely to the world that he knows. He resists mother's wish to change the furniture around in the living room and he blows sky high when she comes home with a new hairdo. Here are some of the first stirrings of what will later become the complacent fantasy. This is the beginning of the child's attempts to stop the march of reality.

At first we all develop these complacent fantasies - that the world will always continue the same - that we shall endure. Most of us, however, go beyond this and attempt to exert some positive control over the world. Many of us go to great lengths to demonstrate our control over the world - sometimes we get burned. Anyway we give it a try and soon learn that there are limits to our control. We learn that at some point we all run out of "smart." In short we learn to plan for the best and expect the worst. We spend a little for today and save a little for tomorrow. We plan to retire yet do not save all of our living until then. We tend to live a full and rational life. Most importantly we learn to identify with the people who don't make it. We learn from the mistakes of others through identification with them. We do not have to experience something to know it is dangerous. We can learn through observation and identification so we do not have to die to learn the best ways to live.

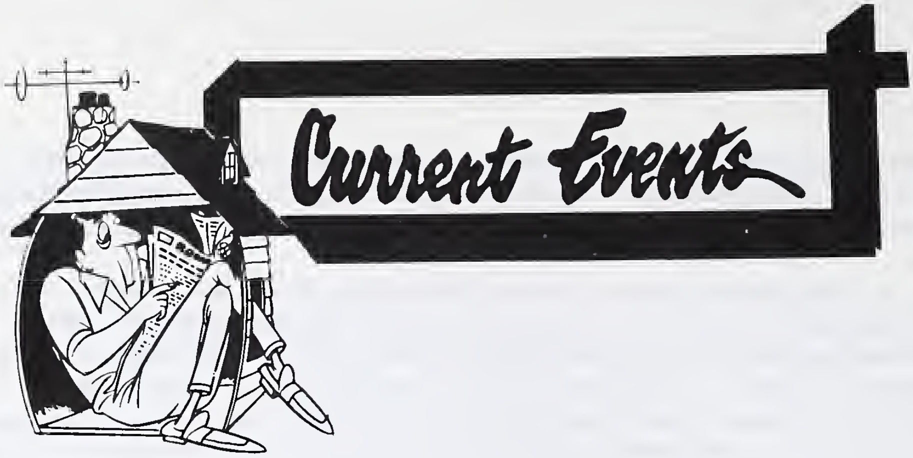
It is the other type of person who becomes the accident statistic. They cannot learn from others. They cannot identify with others because they must continue the fantasy, "Nothing can harm me, I shall endure."

What is it that makes these people different from the mass? What makes it so important that they continue this fantasy form of living and even resist reality? It is because these particular people, more than any others, expect to fail. They, more than any others, have spent much of their early life expecting to be the loser. In some cases it was the lack of a good strong father-relationship with which the person could identify. In other cases it was a period of childhood illness which made the person feel he could not identify successfully with others. In any case it was something that made him feel that he would fail totally in life if he had to muddle through like the rest of us. In each case there was a good and sufficient reason for the person to build a complacent fantasy.

Now when we look at the beginning of the symptom we can see the reason for its continuance. In the reason for the development of a complacent fantasy we also find why it resists any attempts to change.

The person is initially so frightened of the reality that he faces, and so sure that he will succumb to it, that he puts on the complacent fantasy as a defense. He begins to imagine that he will always succeed in whatever he attempts. He does this to hide the fact that he feels he will always fail. This is the reason why the overly complacent person is so resistant to learning or anything which might cause him to identify with the loser. This is the reason why he will sit and comment on the techniques of filming a safety movie rather than identify himself with the characters in it. He dares not identify himself because of the old anxieties he will arouse. This is the reason why the person we call overly complacent, who needs information more than the rest of us, will stoutly resist all of our attempts to inform him. To think of himself in any but the most successful position terrifies him and so he flees back to his fantasy, "I am forever, nothing can harm me, I shall endure."

Approach Magazine



WHEN A SAFETY DEVICE FAILS ......

During the production of 7.62mm ammunition, a detonation occurred in the primer feed hopper of a high speed primer insert machine. The explosion resulted in approximately $2,425.00 damage to the syntron hopper, the primer feed track and windows above the machine. An employee working on an adjacent machine suffered minute second degree burns on her right arm.

Subject operation begins with empty cartridge cases being fed from a hopper located on the mezzanine floor above the machine. The cases enter the machine onto a rotating dial where they are pierced, primed, mouth-water proofed and have varnish applied to the primers. The primers used in this operation are supplied in boxes containing 1,200 each. With the machine in the OFF position, a box of primers is placed within a barricaded dumping device at the rear of the hopper. After the barricade door is closed, the machine is turned ON, a dumping lever is activated and the primers flow into the syntron bowl which supplies the point of operation by means of a feed track.

An <u>interrupter</u> on the feed track is a safety device which shuts the machine off automatically if any of the following occurs:

1. A primer fails to be placed on a cartridge case.

2. A defective primer passes the electric eye of the interrupter.

3. A primer is cocked when positioned in a cartridge case.

Also, if a primer flashes, the interrupter closes to prevent flame propagation into the syntron bowl.

Investigation concluded that a primer detonated on the primer dial and the resultant flash spread to the syntron bowl when the aforementioned interrupter failed to close. The explosion in the bowl consumed an estimated 800-850 primers.

The following measures were recommended to preclude similar incidents:

1. Back-up interrupters will be installed on all high speed priming machines.

2. Operators and toolsetters will frequently check interrupter systems to assure proper operation.

3. The electric eye "detect" holes have been enlarged to provide more instantaneous detection.

*****

CHEMICAL BURNS STRIKE AGAIN

Test personnel were completing pretest operations for a static firing of a LANCE engine. The task at hand involved the transfer of gel propellant (monomethylhydrazine) through a flexible line from its shipping container to the test stand run tank.

The transfer line was first primed for air removal. This was accomplished by disconnecting the flexible line and flowing propellant through the line. Pressure was slowly increased in the shipping container to induce flow through the flexible line. When the propellant reached its rheological breaking point, it suddenly flowed at high velocity, spraying a worker on his face and arms. Although he was immediately placed under a safety shower and washed down with a hose by another employee, the test operator suffered chemical burns about the face and arms.

An unsafe method of line-bleeding was pinpointed as the primary cause of this incident. The injured worker created an even more hazardous exposure by manually handling a pressurized line in lieu of securing the same. In addition, the facial burns might not have occurred had the worker been wearing a face shield which is recommended when handling monomethylhydrazine.

To prevent recurrence of this type of accident, future priming operations will be accomplished with the flexible line connected at both ends. Air will be bled off at the facility tank through a bleed valve.

*****

SAME DRIVER, SAME DAY

An Army civilian employee was dispatched 225 miles to pick up an Army sedan and deliver it to his installation. He arrived to pick up the car on Friday afternoon. In order to avoid an unusually long work day and a five or six hour drive when fatigued, the driver was authorized a one-night lay-over. At 1500 hours Saturday, he left to bring the car back to his installation. When he arrived five hours later, he took the car to his residence, parked and locked it, and slept until approximately 0400 hours, Sunday.

Shortly thereafter he proceeded to the installation with the car. He was following a private vehicle, and as both cars approached a flashing yellow signal at an intersection, the private vehicle increased its speed. The Army driver also increased his speed. Suddenly, the private vehicle stopped, and the Army vehicle, which was following too closely, struck the rear of the POV. This accident resulted in $315 damage to the front of the Army vehicle and $65 damage to the rear of the other car. Neither driver was injured.

After investigation by local police, the driver was allowed to take the Army vehicle to the installation.

Moments later, and approximately one-fifth mile closer to the installation, the Army driver was legally stopped for a red light at an intersection when he was struck from behind by a private vehicle. This resulted in $350 damage to the rear of the Army vehicle, and $150 damage to the front of the private vehicle. Again, neither driver was injured.

No corrective or disciplinary action was taken as a result of the second accident since the Army driver could not have avoided the accident. However, as a result of the first accident, the driver was cautioned to stay within posted speed limits and maintain a reasonable distance behind the vehicle in front of him.

*****

26,400 VOLTS PROVE FATAL

A subcontractor was engaged in roof repairs on a production building at an ammunition plant. One of the workers used a winch on a roofer's ladder to lift an asphalt-impregnated mop to the metal roof. Subject mop had a 6½-foot aluminum handle.

After climbing the ladder, the worker stepped onto the roof and removed the mop from the winch. In doing so he held the mop in close proximity to

a high voltage overhead line (26,400 volts) and the electricity arced from the line into the mop.

Two fellow workers at ground level heard the arcing and climbed the ladder to render first aid and assistance to the yet alive victim. They removed him from the roof with the aid of a forklift and placed him in an ambulance. The worker died en route to the hospital.

Investigation of this accident revealed that the victim assumed an unsafe position by his being unable to appreciate the existing hazard of a high voltage line located from five to six feet above a metal roof. In an effort to prevent recurrence of a similar incident, the power line was scheduled for relocation.

*****

IT WAS NOT TIME FOR CLIMBING

A contractor plumber was installing overhead pipe that required the use of scaffolding. As he was climbing the scaffold, he slipped and fell approximately ten feet to the concrete floor.

He suffered a broken right arm, abrasions on both hands and back pain. He is expected to be away from work for 90 days.

Several unsafe conditions were observed by investigating personnel.

1. The concrete floor was wet.

2. The scaffold was not equipped with a proper climbing ladder.

3. No safety railing was provided on the working level of the scaffold.

4. The scaffold did not have sufficient planks at the working level.

5. General housekeeping in the area was not good.

The injured worker was noted as being inattentive, unobservant and using unsafe equipment.

To prevent possible recurrence, the possible causes of the accident were discussed with the contractor who agreed to take corrective action to eliminate the hazard.

*****

THE AMBULANCE IN THE VALLEY

'Twas a dangerous cliff, as they freely confessed,
Though to walk near its crest was so pleasant;
But over its terrible edge there had slipped
A duke, and full many a peasant.
The people said something would have to be done,
But their projects did not at all tally.
Some said "Put a fence 'round the edge of the cliff,"
Some, "An ambulance down in the valley."

The lament of the crowd was profound and was loud,
As their hearts overflowed with their pity;
But the cry for the ambulance carried the day
As it spread through the neighboring city.
A collection was made, to accumulate aid,
And the dwellers in highway and alley
Gave dollars or cents - not to furnish a fence -
But an ambulance down in the valley.

"For the cliff is all right if you're careful," they said:
"And if folks ever slip and are dropping,
It isn't the slipping that hurts them so much
As the shock down below - when they're stopping."
So for years (we have heard), as these mishaps occurred
Quick forth would the rescuers sally,
To pick up the victims who fell from the cliff,
With the ambulance down in the valley.

Said one, as his plea, "It's a marvel to me
That you'd give so much greater attention
To repairing results than to curing the cause;
You had much better aim at prevention.
For the mischief, of course, should be stopped at its source,
Come, neighbors and friends, let us rally,
It is far better sense to rely on a fence
Than an ambulance down in the valley."

"He is wrong in his head," the majority said;
"He would end all our earnest endeavor.
He's a man who would shirk this responsible work
But we will support it forever.
Aren't we picking up all, just as fast as they fall,
And giving them care liberally?
A superfluous fence is of no consequence,
If the ambulance works in the valley."

Courtesy VT-25
Reprinted from January 1961 Approach Magazine

FLOW METERING OF LIQUID EXPLOSIVES

George F. Dale, Project Engineer
Hercules Incorporated
Radford Army Ammunition Plant

Hercules Incorporated at Radford Army Ammunition Plant has developed a system for flow metering of liquid explosives. W. T. Wilkinson and O. R. Cutler, Process Engineers for the Automated Multi-Base Program, designed a simple, safe and accurate system to remotely control the flow of liquid explosives. Although the specific application was designed for a mixture of nitroglycerin, solvents and stabilizer, it can be adapted for use with any free flowing liquid explosive with viscosity less than approximately 2,000 centipoises.*

The principle employed in the prototype is that a tank with a constant liquid head will deliver a constant flow through an orifice into an open pipe. The formula utilized is:

$$\sqrt{u_2^2 - u_1^2} = C_o\sqrt{2g\Delta H}, \qquad (1)$$

where:
- u_1 = Upstream liquid velocity, feet/second.
- u_2 = Liquid velocity through the orifice, feet/second.
- C_o = Orifice coefficient.
- g = Acceleration due to gravity, feet/second/second.
- ΔH = Head (height x specific gravity), feet.

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* The centipoise is a unit of viscosity measurement. As an example of its magnitude, at 68.6°F., the viscosity of water is one centipoise, while at 60°F., the viscosity of castor oil is approximately 1,400 centipoises.

By design, the tank is sized so that u_2 is so much greater than u_1 that the value of u_1 is, for all practical purposes, zero, Therefore,

$$u_2 = C_o \sqrt{2g \Delta H}. \tag{2}$$

By keeping the liquid head constant on the tank, we are given a constant flow through the orifice into an open line; that is, a line so sized that the outlet discharge from the line never fills so as to create a back pressure. The means of measuring the head and maintaining it as a constant are described in the following paragraphs.

The design of the flow meter tank (nicknamed "top hat" from its shape) is shown in Figure 1. The principle of the level controller which maintains the constant head is the same as that used in pneumatic-type tank level meters, where the pressure required to maintain a small air flow (less than 1.0 CFH) through a tube (positioned close to the bottom of the tank) is balanced against the pressure to maintain the same air flow to the atmosphere. This difference in pressure is measured by a differential pressure cell (d/p cell), which sends a signal to the control valve to vary the flow. The d/p cell is located at a height above the tank, precluding contamination by the explosive. The dip tube is offset to one side to avoid turbulence at the orifice. The inlet orifice, and the pressure used to produce incoming flow, are designed to minimize turbulence in the tank caused by the flow of incoming liquid.

The flow meter tank is used in the Automated Multi-Base Program to control the flow of a mixture of nitroglycerin, solvents, and stabilizer to a premixer for mixing with metered solid ingredients. The complete system consists of a pressurized tank (10 psig maximum) which provides the driving force. The flow from this tank is controlled by a pinch valve on signal from the d/p cell. There is a shutoff valve on the feed line to the distributing weir at the premixer. Both these valves are spring-loaded to "fail closed." The lines transporting NG/solvent are standard rubber NG pressure hose lines, sized to be below the critical diameter of the material transported to prevent shock propagation. If the primary feed stops, a quick shutoff of the liquid flow (less than 5 seconds) is obtained by an interlock which closes the valve, preventing introduction of the liquid explosive into the premixer if no solid material is present. In the facility design gravity may be substituted for the pressurized tank as the driving force for the liquid. A portable desiccator, used in casting operations, was used in this prototype for convenience and availability.

A constant liquid level in the "top hat" is maintained by the pneumatic control system (Figure 2), which varies the degree of pinching of the liquid feed hose in response to signals from the d/p cell. These signals are fed through a square root extractor to obtain linear signals,

CONSTANT HEAD LIQUID FLOWMETER

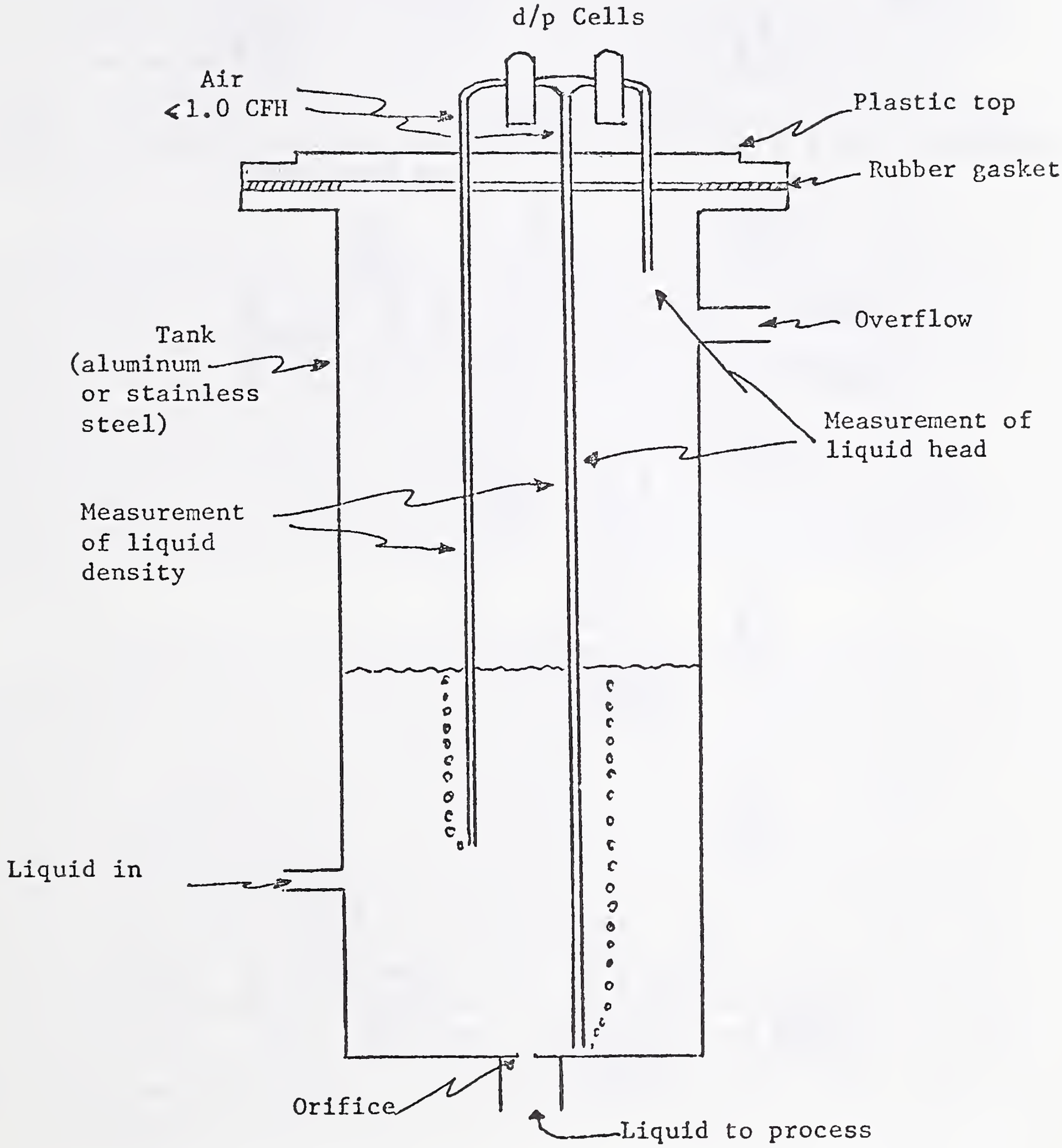

Figure 1

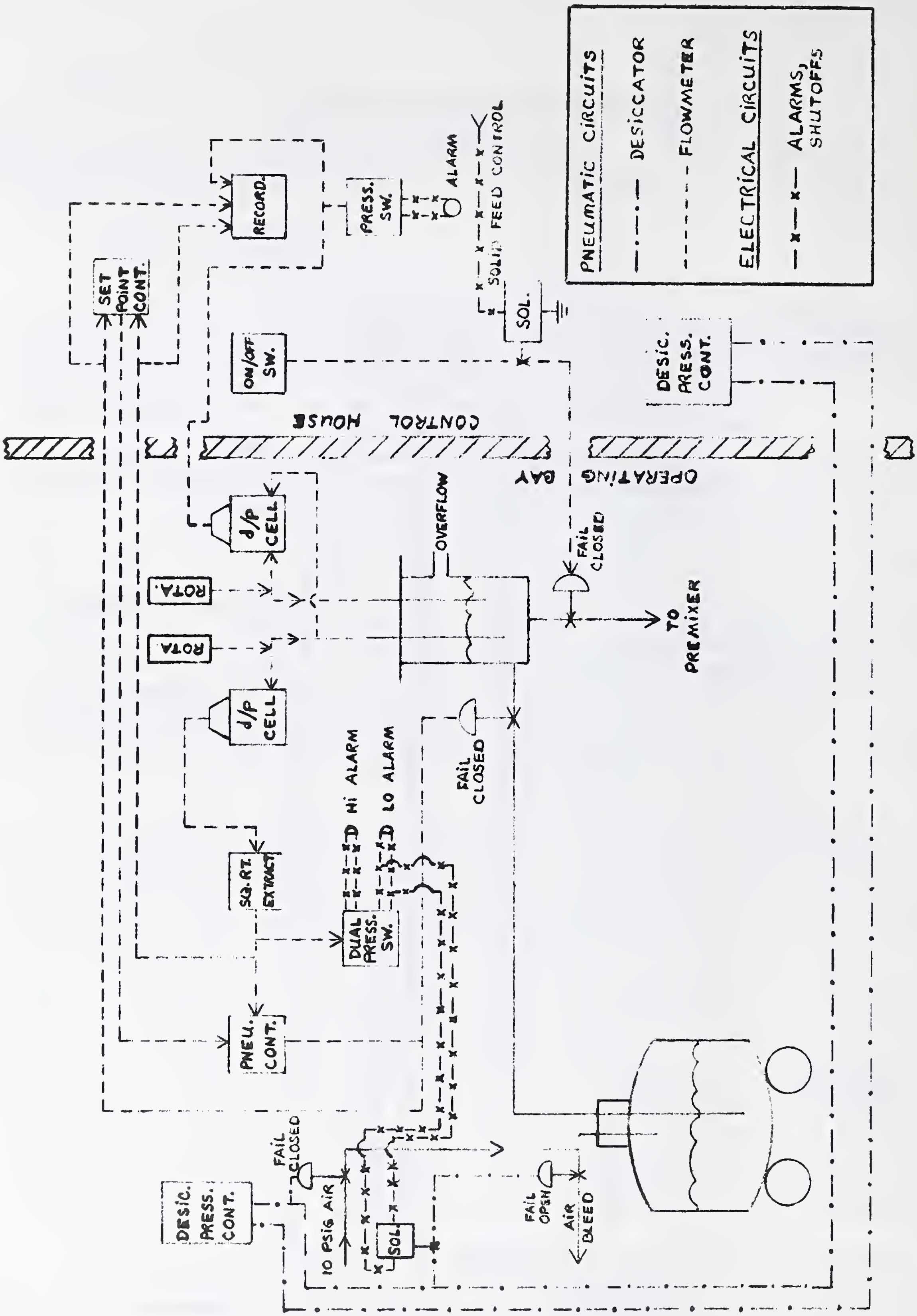

Figure 2
Schematic Diagram of Metering Control System

which are then fed to the feed valve controller. The system diagrammed has set point and off/on desiccator controls in a remote control house, with the desiccator controls duplicated in the operating bay for convenience during inert calibration runs. The control system is interlocked with alarms to warn of high or low levels in the flow meter tank. The low level alarm, which could indicate a serious leak of NG/solvent somewhere in the system, also depressurizes the desiccator by means of a solenoid valve which cuts off the air to the "fail open" bleed valve on the desiccator, thereby stopping flow quickly in the event of instrument malfunction or failure of the NG/solvent feed line. The high level alarm is limited to warning only, since the overflow by-pass is designed to be greater than the feed line. The automatic control system, because of the interlocks, must be by-passed with manual controls during start-up periods. Rotameters are used to control the air flow through the d/p cells.

Specific gravity readings are taken to assure the NG/solvent mix is within specified limits. This is accomplished by a second d/p cell, connected to both a short tube and to the long dip tube, which constantly checks the specific gravity of the liquid, using the principle of a fixed distance between the ends of the tubes so that the difference in air pressure required is directly proportional to the specific gravity. The variation in pressure required to bubble air through both tubes is measured by this second d/p cell, which is calibrated to give a direct readout of specific gravity. Calibration of the first d/p cell gives a direct readout of the liquid head on the orifice, and thereby a direct readout of the flow. While two separate bubble tubes are shown in the diagram, both tubes can be incorporated in one polyethylene rod for simplicity.

For convenience, the original flowmeter tank and the exposed pinch valve parts were machined from solid blocks of 6061-T6 aluminum to avoid possible difficulties in welding for liquid explosive service. Facility tanks will be constructed of stainless steel, with which such welding is practical. The tank, as constructed, is of seamless material and has a one-piece lid which contains two rigid plastic tubes with a minimum of friction, permitting easy removal for cleaning. The tubes are constructed of high density polyethylene rod, drilled to the desired tube size, for rigidity. As constructed and sized, this system provides a flow range of 0 to 0.4 gallon per minute with a desired flow level of 0.25 gallon per minute. Liquid level in the tank is five inches. At a flow rate of 0.25 gallon per minute, this system will maintain a steady flow with less than 0.5 per cent instrument scale variation, which is equivalent to $\pm$ 0.005 gallon per minute. There is a slight, but measureable, effect of liquid viscosity on the flow rate. Temperature variation in the range of 40 to 100^{o}F. has very little effect, as liquid viscosity changes very little over this range.

The metering system was thoroughly checked out with water and glycerin/water mixtures before trying runs with a "live" liquid explosive mixture. Agreement between the inert and the live runs was excellent.

For developmental purposes, a potted plastic insert was used for the orifice. Such an orifice could be easily changed if necessary. This insert is removed and cleaned after each run, as is the socket for it, after which it is reinserted and repotted. Tests have shown that the original calculations gave the correct orifice size, and a permanent installation for continuous operation will have an orifice drilled in the bottom of a stainless steel constant head tank, eliminating possible collection points for nitroglycerin.

The Automated Multi-Base Program process uses a mixture of nitroglycerin/alcohol/acetone/stabilizer equal to 55.6/4.4/26.4/13.6 per cent. Dilution of the nitroglycerin, as shown by sensitivity tests, greatly reduces the sensitivity of the explosive and increases the safety factor. With a properly sized tank and orifice, the system described may be adapted for metering any freely flowing liquid explosive, and would provide a safe, remotely controlled, accurate metering system for the liquid explosives.

Hercules Incorporated will continue in the effort to create a safer workplace and environment. This safe, automated liquid explosive metering system is another example of how safety can be incorporated in modernization programs.

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Do You Know?

Here are ten questions that will test your knowledge of safety requirements that you will need under different circumstances. Answers to these questions may be found in the AR and AMCR 385-series. How many can you answer without referring to the regulations?

1. What factors are to be considered when determining the need for and specific kinds of personal protective clothing and equipment for an operation?

   Answer and reference:

2. What type of fire fighting equipment may be issued to working crews in the magazine area?

   Answer and reference:

3. What factors determine ammunition and explosives storage compatibility groupings?

   Answer and reference:

4. What items are included in the "ammunition" category?

   Answer and reference:

5. When portable engine-driven generators are used for generating current to explosives magazines or operating facilities, what precautions shall be taken?

   Answer and reference:

6. What is a "safety statement?"

   Answer and reference:

7. What regulation(s) govern the range safety requirements for DA weapons, munitions, and explosive devices to be used in troop training?

Answer and reference:

8. What is the purpose of a pre-accident plan as part of a command/installation aviation safety program?

Answer and reference:

9. What personnel classifications are to be included in the quarterly Summary Report of Federal Occupational Injuries and Illnesses for Civilian Personnel (DA Form 3885-R)?

Answer and reference:

10. What is the purpose and distribution of DA Form 3886-R, Log of Occupational Injuries and Illnesses?

Answer and reference:

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NEW PUBLICATIONS

AR 385-16 22 Sep 72	Safety - System Safety
AR 385-40 15 Aug 72	Safety - Accident Reporting and Records
AMCR 385-12 29 Jun 72	Safety - Life Cycle Verification of Materiel Safety
AMCR 385-24 11 May 72	Safety - Range Safety
AMCR 385-26 14 Mar 72	Safety - Aviation Safety
FM 3-21 14 Aug 72	Chemical-Biological Accident Contamination Control

WHY SOME DRIVERS DIE

(A Two-Part Story)

It stops and makes you think when someone close to you -- a beautiful child or a teenager, or an executive with a brilliant future -- dies unexpectedly.

We ask ourselves, "Why them, of all people?"

Why DOES sudden tragedy touch some young and beautiful persons? Recently, a member of the Highway Foundation's accident research team told about two accidents which happened within a few hours of each other.

Four students in their late teens were on vacation from college. They had been friends all their lives and had been in the same graduating class in high school.

One of the boys was a natural athlete and received an athletic scholarship to a midwestern college. The other boy was studying engineering at a western university. The two girls were studying education and both were planning on becoming school teachers.

Their double date that evening included plans for attending a basketball game at their high school alma mater and a visit to a local pizza shop.

Everything went as planned. Since one of the girls had to be home by 1:00 A.M., they left the pizza shop shortly after midnight.

As the car moved down a well-lighted residential street, it hit a patch of ice and began to spin. The boy at the wheel was unable to control it and the vehicle slammed into a utility pole.

Upon impact, the engineering student and the girl beside him were tossed out of the car like rag dolls. Somehow, the boy landed under the vehicle and died a few hours later of a crushed skull. The girl received a broken back.

The young couple in the rear seat received only minor cuts and bruises. Ironically, damage to the vehicle was estimated to be less than $500.

It was established that not one of the young people was wearing safety belts although the car was equipped with both lap and chest belts. After investigating the accident, Foundation researchers estimated that, had the belts been used, it is doubtful that any of the occupants would have been seriously injured.

Here's the second half of the story.

About two hours later, a 44-year-old salesman was headed home from a local bar which had closed for the night. He had spent most of the evening in the bar, drinking steadily. As he drove down the street at a speed estimated to be considerably over the limit, he misjudged a curve and lost control.

The car sheared off a telephone pole, careened into a store front and slammed into several parked vehicles before coming to a halt. The auto was literally cut in half, and it took rescuers over an hour to free the trapped driver pinned inside.

When lifted from the wreckage, the driver refused to go to the hospital. With the exception of several small cuts on the face, he was not injured. It appeared to be a miracle.

Under questioning, the salesman stated that he traveled a great deal of the time and was in the habit of using his safety belt. Fastening them had become a habit with him; and it turned out to be a habit that undoubtedly saved his life. He was cited for driving while intoxicated. It was so obvious that he admitted it.

Why did tragedy touch the college students and not the salesman? The answer is clear -- and it wasn't because the salesman was drunk, and therefore, relaxed! In one case safety belts were used; in the other, they were not.

Unfortunately, this is not an unusual story. Similar tragedies will take place hundreds of times this year.

In a study of 4,571 accidents involving 12,000 car occupants, the Highway Safety Foundation research team observed that the chances of being killed are five times greater for unrestrained front seat occupants than those wearing safety belts.

Use your belts. It could save your loved ones from asking the question, "Why him, of all people?"

-- CAAPtion
Mason & Hanger - Silas Mason Co., Inc.
Cornhusker Army Ammunition Plant

REAR STEP SAFETY DEVICES FOR STRUCTURAL FIRE PUMPERS

Raymond A. Dratt, Fire Chief
Sharpe Army Depot

Fire trucks at Sharpe Army Depot have been equipped with a belt device on the rear step to prevent personnel from losing their balance and falling off vehicle while en route to an emergency. These belts have not been satisfactory since it was difficult if not impossible to don protective clothing while wearing them. Further difficulty was encountered when personnel attempted to unbuckle the belts quickly while wearing the standard protective gloves.

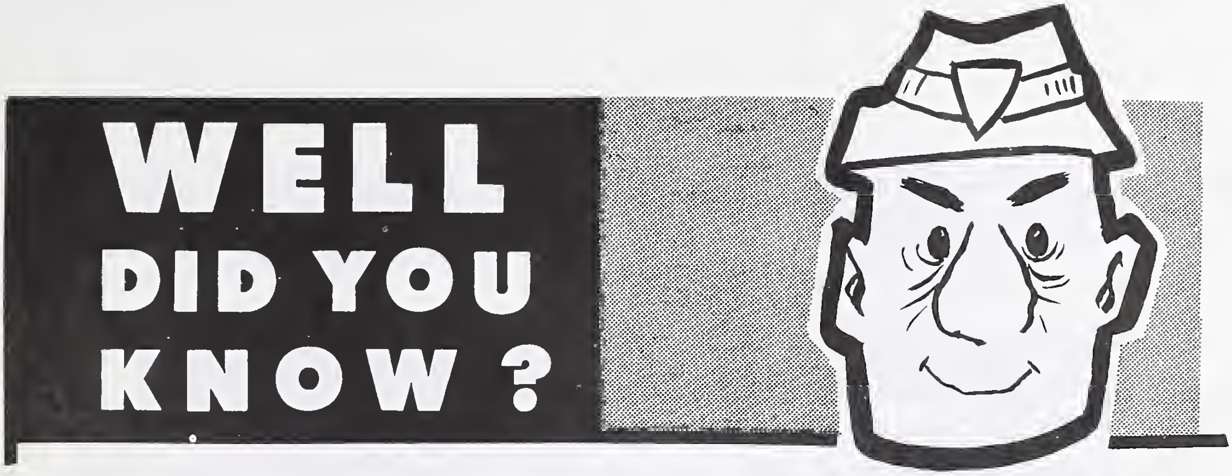
In search of a better method, a safety bar was found. This chromed steel device consists of a rod on two arms which swings from a vertical position in a 90 degree arc and at the lower position is behind the firemen on the rear step of the truck. When raised the rod locks in a position well above the hose load, out of the way. This safety bar provides for free movement of personnel in putting on bunker coats, gloves, and helmets while providing security from falling off the vehicle.

A suggestion was made that a lock be installed which would prevent the bar from raising inadvertently, possibly from striking a pot hole or other sharp bump. Our maintenance personnel devised a spring loaded catch mounted in the vertical handhold bar on the left side of the hose load that would automatically lock the safety bar as it reached the lower position. Release of the safety bar is effected by manually holding the spring loaded catch in the unlocked position while the safety bar is being raised.

Firemen riding the back of our structural vehicle have indicated great enthusiasm for this safety feature and one instance has been reported where a fireman lost his balance after hitting a rough railroad track. He quickly regained his balance as the safety bar checked his backward movement. All structural pumpers in use at Sharpe Army Depot are now equipped with this safety feature.

Bar in lowered position without lock.

Bar in lowered position with lock.



Here are the answers to the questions on pages 19 and 20. A reference to the pertinent regulation and paragraph follows each answer.

1. Factors to be considered when determining the need for and specific kinds of personal protective clothing or equipment are: specific exposure, employee habits and unsafe acts, accident experience (including correlation of parts of body injured with agencies producing injuries), employee suggestions, and appropriate nationally accepted standards. Reference paragraph 10-2, AMCR 385-100.

2. When water barrels and pails are not available, working crews in the magazine area are equipped with two water-type hand extinguishers, preferably of the 2½-gallon capacity, pressurized anti-freeze type, the 4-gallon back-pack hand-type, or the multipurpose dry chemical extinguishers with a minimum classification of 3A. Reference paragraph 12-20b, AMCR 385-100.

3. Ammunition and explosives are grouped for compatibility with respect to the following factors:

   a. Effects of explosion on the item.

   b. Rate of deterioration.

   c. Sensitivity to initiation.

   d. Type of packing.

   e. Effects of fire involving the item.

   f. Quantity of explosive per unit.

   Reference paragraph 19-2, AMCR 385-100.

4. Ammunition includes cartridges, projectiles, grenades, bombs, pyrotechnics and mines, together with projectiles such as bullets, shot, and their necessary primers, propellants, fuzes and detonators. Reference paragraph 2-3, AMCR 385-100.

5. When generators are used for generating current to explosives magazines or operating facilities, the following precautions shall be taken:

   a. The generating unit shall be placed at least 50 feet from any explosives facility.

   b. The ground area between the generating unit and the explosives facility shall be clear of debris or other combustible materials.

   c. The flexible cord should be temporarily supported from the exterior of the explosives facility to the power supply in such a position as to prevent trucks or personnel from running over or otherwise damaging the cables.

   d. Refueling shall comply with requirements of paragraph 24-5, AMCR 385-100. Suitable extinguishers will be kept ready for use during all refueling operations.

   e. The generating unit and the gasoline supply containers shall be so located that spillage of gasoline would flow, by gravity, away from the explosives facility. If necessary, a trench shall be built to prevent spilled gasoline from reaching the explosives facility.

   Reference paragraphs 6-23b(1) through (5), AMCR 385-100.

6. A "safety statement" is a formal, comprehensive summary of data collected during concept, design, and development phases of an item, and is available prior to engineering test of the item. It expresses the considered opinion of the developing agency regarding any hazards that may be presented by the materiel and the actions or limitations that are recommended to minimize these hazards and to reduce the exposure of personnel and equipment to them. The <u>Interim Safety Statement</u> is a summary of the data available and the developer's safety evaluation for the development suitability test, engineer design test, or other tests performed before the engineering test. Reference paragraph 3a, AMCR 385-12.

7. Range safety requirements for Department of the Army weapons, munitions, and explosive devices to be used in troop training will be contained in either AR's 385-62 and 385-63. Reference paragraph 4a, AMCR 385-24.

8. The purpose of a pre-accident plan is to insure that prompt, effective and orderly crash rescue, fire fighting, and accident investigation procedures are executed in the event of an aircraft accident. Reference paragraph 2-3a(3), AMCR 385-26.

9. Only injuries and illnesses sustained by Department of the Army Federal Civil Service employees, including Army National Guard technicians, and US citizen non-appropriated fund employees are to be included on the DA Form 3885-R. Reference paragraph 10-2, AR 385-40.

10. DA Form 3886-R will be maintained for the purpose of analyzing Occupational Safety and Health Act (OSHA) experience of all activities of a command/installation. However, the completed form will be retained at the installation or activity headquarters. Reference paragraph 10-4b, AR 385-40.

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HATS OFF TO HARD HATS

James J. Mayr, Safety Specialist
US Army Tank-Automotive Command

Harry Bugaj of the Roads and Grounds Section, US Army Tank-Automotive Command, was mowing a large field with an International tractor pulling a gang mower.

During the mowing operation, the right front wheel of the tractor dropped into a deep hole which was hidden by grass and weeds. The sudden motion caused the operator to lose his grip on the steering wheel, lurch forward and impact the vehicle's windshield with his head.

Force of the blow was of such magnitude that the windshield was shattered and several rivets supporting the hard hat's suspension were sheared. Due to Mr. Bugaj's good judgment in utilizing personnel protective equipment, a serious head injury was prevented. In fact, he claims he didn't even get a headache.

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SUMMER SAFETY ON DISPLAY

Reviewing the US Army Electronics Command "Summer 72" Safety Exhibit are MG Hugh F. Foster, Jr., Commanding General, and Bernard Savaiko, Safety Director. The program stressed individual responsibility for avoiding summer hazards in off-duty activities.

Are You Putting Me On ?

ZERO in

Slips, Trips and Falls